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ABSTRACT

In 1975, a joint committee on physical fitness, composed of the Measurement and Evaluation, Physical Fitness, and Research Councils of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) studied its Youth Fitness Test to determine the need for revision. Study results called for: (1) alteration in traditional physical fitness concepts to distinguish health related and performance related fitness; (2) revision of the AAHPER Fitness Test to place increased emphasis on evaluation of health related physical fitness; and (3) use of norm-referenced and criterion-referenced standards for test-score interpretation. A task force was appointed, and a test battery, the Health Related Fitness Test (HRFT), the purpose of which was to evaluate physical fitness components associated with prevention of disease and with the promotion of physical health, was designed. Areas presently identified as important for functional health were cardiorespiratory function, body composition, and abdominal and low back musculoskeletal function. The HRFT battery includes: distance runs to measure cardiorespiratory function; skinfolds to measure body fat and estimate body composition; modified sit-ups to evaluate abdominal muscular strength and endurance; and sit-and-reach tests to evaluate flexibility of the lower back region. Test results can be used in diagnosis, exercise prescription, program evaluation, or educational elements. (JMK)

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Health Related Physical Fitness:

Who, What, Why, and How

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Physical education programs have an important role in our society and should promote important lifestyle changes. The promotion of physical fitness in youth is an objective of many organizations including public schools, YMCA's, and youth sport programs. Most current and past programs have emphasized fitness status relative to certain standards or norms. Yet, the use of physical fitness information to individually prescribe exercise routines or to encourage future commitment towards exercise has been ignored. Nevertheless, current evidence clearly indicates the need to provide youth and adults with this kind of information (Pate, 1982).

Physical fitness has been described as "a multifaceted continuum which measures the quality of health ranging from death and diseases that severely limit activity to the optimal functional abilities of various physical aspects of life" (Plowman and Falls, 1978). The important point in the above definition is that health and physical fitness are interrelated and important to the life of each individual. Fitness tests should have the ability to measure on the continuum, assess capacities that can be improved with activity, and accurately reflect an individual's fitness status and changes in that status by test scores and changes in these test scores (Plowman and Falls, 1978).

In 1975, a joint committee on physical fitness composed of the Measurement and Evaluation, Physical Fitness, and Research Councils of AAHPERD studied the Youth Fitness Test to determine the need for revision. The outcome was a position paper which called for: (1) alteration in traditional concepts of physical fitness to distinguish health related and performance related fitness; (2) revision of the AAHPER Fitness Test to place increased emphasis on evaluation of health related physical fitness; and (3) use of norm-referenced and criterion-referenced

standards for interpretation of test scores (Cureton, 1980). A task force was appointed and a test battery designed to evaluate physical fitness components associated with prevention of disease and with promotion of physical health (Pate, 1982). This battery of tests represents a philosophical switch from previous directions and does not measure "overall fitness" or "athletic fitness", but parameters important to health. Realizing that physical fitness encompasses a broad spectrum in the life of an individual, the task force developed the Health Related Fitness Test (HRFT) battery as a way of looking at one aspect of the total fitness continuum -- a part more closely related to health than performance.

There has been some resistance to the HRFT or maybe resistance to change. Some individuals do not view physical fitness as health related, but primarily as performance related. The problem stems from a failure to understand the basic difference between health related and performance related fitness coupled with a lack of appreciation of the importance of health related fitness to all children, youth, and adults (Falls, 1980). Health related fitness offers protection from "hypokinetic diseases" -- diseases associated with low levels of energy expenditure common to sedentary individuals such as coronary heart disease, obesity, and musculoskeletal disorders. Performance related fitness concerns the ability of an individual to participate in sports. Many elements of HRFT are also important components of performance related fitness. The major difference lies in the degree of development of the components (Falls, 1980).

The areas presently identified as important for functional health are: cardiorespiratory function, body composition, and abdominal and low back musculoskeletal function. Though there are sufficient data to

suggest that improvements in cardiorespiratory function and body composition are seen with regular physical activity, limited data exist relating musculoskeletal dysfunction to abdominal and low back pain. However, clinical evidence indicates that low back pain and tension may be decreased by physical activity.

The following paragraphs describe each test item included in the Health Related Fitness Test battery. Detailed information pertaining to distance runs and body composition in children have been included. Norms for the tests were developed from over 12,000 school age children in 13 states during the Spring, 1979. Norms for college age individuals are currently being developed from data collected from 30 colleges and universities. Therefore, the age range to be covered by this test battery is five through college age. The test manual presents these data by sex and age (AAHPERD, 1980).

Cardiorespiratory Function

Cardiovascular disease has reached epidemic proportions in our country with coronary heart disease a major killer. Significant numbers of children already exhibit cardiovascular risk profiles, and some have evidence of multiple risk factor development at an early age (Gilliam and Katch, 1980). The risk factors of concern here are the secondary risk factors for cardiovascular disease which are obesity, diabetes and/or elevated blood glucose levels, stress, ecg abnormalities, and physical inactivity. Such risk factors may interact with the primary risk factors of age, sex, family history, blood pressure, cholesterol, and cigarette smoking. Many of these risk factors may be reduced through regular physical activity such as aerobic exercise. Therefore, distance runs were included in the HRFT because endurance running does reflect some

undefined combination of cardiorespiratory function, body structure and running ability and can easily be administered to large groups in a short time. No one test can reflect all the components of cardio-respiratory function, and in a school setting, highly technical tests are impractical.

Distance runs measure the maximal average speed that can be maintained over a given distance or time and are used to indicate endurance capacity. However, they are not strictly measures of endurance capacity though they are related to maximal oxygen consumption as measured on a treadmill stress test. The test score can be influenced by individual differences in factors such as body fatness, running skill, motivation and proper pacing that are not related to the endurance capacity of the child. Cureton (1982) suggested that only 25% or less of the variance in distance running performance is actually related to cardiorespiratory endurance capacity in children. Therefore, these runs measure a complex interaction of many biological variables such as cardiorespiratory capacity, body fatness, anaerobic threshold, and running efficiency. In addition, during the growth and development years, it is difficult to distinguish growth and maturation changes from changes related to physical activity (Cureton, 1982).

The purpose of distance runs as described in the test manual is to measure the maximal functional capacity and endurance of the cardio-respiratory system (AAHPERD, 1980). The distance runs may be conducted in two ways: (1) by running a set distance -- mile or 1.5 miles for a timed score; (2) by determining the distance covered in a set time -- 9 minutes or 12 minutes. The shorter runs are generally suggested for the younger age groups and the longer runs for the older age groups.

Further detail of track lay-out and specific instructions may be found in the test manual.

Regardless of the problems that may be found in distance running tests, such tests do evaluate or assess the underlying physiological capacities necessary to perform aerobic work. These capacities are different from those that would be assessed by shorter runs. Students scoring low (below the 50th percentile) on this test item should be placed on a program to improve their endurance capacity.

Body Composition

A major concern in this country is obesity, which is an enlargement of the body's total fat tissue. Only a modest relationship has been suggested to exist between obesity and cardiovascular disease, but obesity has been directly related to high blood pressure, high blood cholesterol levels, and adult-onset diabetes. Not only is obesity a secondary risk factor for cardiovascular disease, but it is also linked to pulmonary respiratory disease, osteoarthritis, degenerative joint disease, gout, endometrial cancer, and problems with administration of anesthetics during surgery.

The upper limits for a healthy level of body fat are below 19% for males and below 25% for females. Such percentages are the values of fatness that are compatible with health status (Plowman and Falls, 1978). Unfortunately, obesity has reached epidemic proportions in this country, with conservative estimates indicating 30 to 40% of the adult population as overfat. Other estimates indicate that as much as 50% of the adult population and 40% of the total population are overweight. It has been estimated that if all deaths related to obesity were removed, lifespan would increase five years (Falls, 1980). Reduction in excess body

fat is one of the best personal preventive and rehabilitative health practices available.

Many problems are evident when attempting to measure body composition in children. At the present time, neither valid laboratory methods nor field methods have been identified, though current research is providing new directions. The most often used laboratory methods for assessing body composition such as estimation of body density, body water, and body potassium content are based on assumptions geared to an adult population. The body fat percentages estimated from such procedures are based on the assumption that children are chemically mature. When using these methods, the mean body fat content of children has been estimated at approximately 20%. Children are not chemically mature and may have a higher water content and lower potassium and mineral content than adults, giving the impression of increased body fatness (Lohman, 1982).

Field methods presently in use to estimate body composition parameters of children include skinfolds, circumferences, and diameters. The use of such measures to quantify body fat content in children is not acceptable because the prediction equations already developed do not apply to children. In addition, limited knowledge exists of the changes that occur in fat free body and body fat of children during the growth and development years so that development of accurate equations is questionable at this time. The most valid approach for estimation of body composition using field methods is normative anthropometric data rather than the calculated body fat percentages. Even when using normative data, these indirect methods of body composition estimation should be considered carefully. Limitations exist in the use of indirect methods such as: large errors in data due to faulty technique; improper

measurement site location; use of calipers other than the Lange caliper, which was used to determine the norms; measurement error as a result of inexperienced testers, and lack of practice (Lohman, 1982).

Even though many limitations exist for the use of the field methods for assessment of body composition, the skinfold test can be used to determine if a student is within the acceptable range of body fatness early in life and provide direction when necessary. The purpose of the body composition skinfold test as described in the test manual is to assess the percentage of the body weight of the child that is fat. To obtain the measure, two skinfold sites -- the triceps, which is halfway between the elbow and acromion process of the scapula, and the subscapular, located approximately one cm below the inferior angle of the scapula -- have been identified. Such sites are easily accessible and highly correlated with total body fat. The measurement of these skinfolds requires practice, and measurement procedures have been standardized and should be closely followed. An expert is needed to guide beginning testers. Even when 50 to 100 subjects have been tested, problems may be encountered when attempting to measure the overweight or obese child. In addition, improper clothing may present additional problems. Since inter-tester error is high, the same tester should be used for each session to reduce false data and misinterpretations. Other test suggestions and scoring procedures are outlined in the test manual (AAHPERD, 1980).

Once the skinfold measurements have been obtained, problems with interpretation of the data could occur. The exact relation between skinfold fat and total body fat is not fully documented; thus, the exact amount of body fatness cannot be determined with accuracy. However, low percentile rankings, as determined through the skinfold measures, reflect

a higher degree of body fatness. It should be noted that skinfold fat and body fatness vary with age and sex so that a given skinfold thickness does not correspond to the same body fat content for the various age groups. The criterion is the 50th percentile; students below the 50th and above the 25th percentiles should maintain their present body weight for the current year. For children with rankings below the 25th percentile, the recommendation is for a reduction in body fat through the proper exercise and diet regimen. Children with percentile rankings above the 90th percentile are considered exceptionally lean. Further weight reduction is not suggested, and if done, could involve muscle tissue loss with undesirable consequences for health and performance as well as growth and development.

The use of skinfold measures to estimate an acceptable range of body fatness in children is desirable. As mentioned in previous paragraphs, many health problems associated in later life begin in the early years. This test provides a quick and easy way of providing feedback early in life relative to body fatness and tendencies toward obesity.

Musculoskeletal Function

Many individuals believe that weak muscles that easily fatigue or strain cannot support the spine in proper alignment. Weak abdominals allow a pelvic tilt with concurrent back arch which may lead to bachache or back pain. In addition, inflexible muscles may result in low back syndrome, increased chance of muscle injury during activity, and reduced performance capabilities (Corbin and Noble, 1980). Approximately 16% of the population suffers from classical low back pain syndrome, and approximately 80% suffers with simple low back pain

(Plowman and Falls, 1978). The timed bent knee sit-up was selected as marginally acceptable as a measure of abdominal strength/endurance. It does not, however, emphasize back and hip flexibility. The sit and reach test was selected to represent the extensibility of the low back region. Much less controversy exists about these two items though there are some questions pertaining to exactly what is being measured. Each test item is briefly described below.

As stated in the test manual, the purpose of the modified sit-up test is to evaluate abdominal muscular strength and endurance by performing as many correctly executed sit-ups as possible in 60 seconds. Special attention should be focused on test position for the performer, which requires that the arms remain crossed on the chest, the feet remain flat on the floor and approximately 12 to 18 inches from the buttocks, and the chin remain tucked to the chest throughout the test. Any improperly performed sit-up is not counted toward the final score. Failure to obtain an adequate percentile suggests prescription of an exercise routine to improve weaknesses in this area.

The purpose of the sit and reach test is to evaluate the flexibility or extensibility of the low back region and posterior thigh (AAHPERD, 1980). The proper position is described in the test manual as a seated position with the knees fully extended and feet shoulder width apart. A specially designed box or any item with a metric ruler attached may be used to assess this parameter as long as the 23 cm point on the ruler is even with the soles of the feet. The score for the test is the most distant point touched by the fingertips of both hands on the fourth trial. Caution should be taken when administering this test to prevent muscle pull. Adequate warm-up must be provided by slow stretching of the low

back and posterior thigh. The test manual contains several suggestions for appropriate warm-up activities. Once again, should a low percentile ranking (below the 50th percentile) be found, an exercise program should be designed to improve this fitness parameter.

Use of Test Results

The importance of the HRFT lies not with the administration of the test battery to students, but with what is done after the percentiles have been computed. The test manual provides basic guidelines for providing exercise prescription in all areas tested. It is unfortunate that the administration of the tests has been a once-a-year or twice-a-year phenomenon with little emphasis placed on the information inbetween test administrations. In the past, the tests have had little or no meaning to a program, the students, or the instructor because scores and follow-up testing were ignored along with information pertaining to development and maintenance of health and fitness. By providing some background, offering assistance, and showing the importance of fitness to health and to a lifetime commitment to exercise, it will be much easier to incorporate these items and their related materials into the total curriculum.

Some suggested uses of the test results are as follows (AAHPERD, 1980):

Diagnosis -- Results may be compared to one's previous scores, to norms of the population, or to set standards to determine where the score lies on the physical fitness continuum.

Exercise Prescription -- By using the results, programs of exercise can be developed for each individual. Information is provided in the manual to assist with exercise prescription. In addition, colleges and universities have qualified personnel such as exercise physiologists who can help with prescription of exercise.

Program Evaluation -- Group results may indicate how effective an exercise program has been in producing desired change or may indicate the current state of the program in relation to physical fitness parameters. The results provide guidelines for program needs and goals.

Educational Elements -- Use may be made of the testing situations and the results to inform students, faculty, parents and community of the principles of health related fitness.

Other uses of the test results or test administration sessions include accountability, public relations, student motivation, and achievement of curricular goals and objectives.

Summary

The position taken by the development of the Health Related Fitness Tests was intended "to reflect the best scientific research and empirical evidence relative to physical fitness measurement presently available" (Plowman and Falls, 1978). The committee decided that it was time to differentiate physical fitness related to functional health from physical fitness related primarily to athletic ability and performance. There is still some question regarding the absolute validity of some of the suggested health related items, and their applicability to young children is not completely known. However, there was sufficient research to support the incorporation of these items into a battery of tests to determine health related fitness. It is expected that changes will be made in these tests or norms as more research is completed on children and their growth and development patterns. But, this test battery represents the awareness of the importance of physical activity to health even at a very early age. The tests may serve as a tool to aid in learning of physical fitness objectives, as a screening device

for children with basic health problems, or as a motivation for children and adults. Perhaps most importantly, the tests may be used as a part of a plan to educate people to lifetime fitness and health concerns (Pate and Corbin, 1981).

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